



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 4, April 2023

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

 [ijirset@gmail.com](mailto:ijirset@gmail.com)

 [www.ijirset.com](http://www.ijirset.com)



# Smart Agro Study using IoT

**Prof. Rakshak Sood<sup>1</sup>, Anushka Rane<sup>2</sup>, Tanvee Jaiswal<sup>3</sup>, Shruti Biyani<sup>4</sup>, Rithika Kothur<sup>5</sup>**

<sup>1</sup> Assistant Professor, Department of Electronics and Computer Science, Vidyalankar Institute of Technology, Mumbai, India.

<sup>2</sup> Student, Department of Electronics and Computer Science, Vidyalankar Institute of Technology, Mumbai, India.

<sup>3</sup> Student, Department of Electronics and Computer Science, Vidyalankar Institute of Technology, Mumbai, India.

<sup>4</sup> Student, Department of Electronics and Computer Science, Vidyalankar Institute of Technology, Mumbai, India.

<sup>5</sup> Student, Department of Electronics and Computer Science, Vidyalankar Institute of Technology, Mumbai, India

**ABSTRACT:** Since early times agriculture and farming have been important parts of the Indian economy India is heavily reliant on the agriculture industry which also significantly boosts our Economy The amount and quality of the crops are greatly influenced by rainfall and climatic conditions It is essential to watch these variables to manage and enhance the crops' productivity and quality It is urgently necessary to combine new technology with traditional farming methods to assist the agriculture sector There is a need for a smart device for farming and gardening as IOT (Internet of Things) becomes more and more common and everything becomes smart Consequently a novel IOT based system will be useful to address this issue Consequently a new IOT based system will be useful to address this issue IoT makes knowledge more accessible and uses it to inform crucial decisions by separating out the values obtained from instruments such as soil moisture water level sensors water quality etc. Watering is both the most crucial and labour-intensive practice in daily farming or gardening activities No matter the weather whether it's too hot and dry or too cloudy and damp you won't be able to control how much water gets to your plants. Modern watering equipment could be used effectively when plants need to be watered.

**KEYWORDS:** India, Smart Irrigation, Internet of Things, ESP32, Wi-Fi, Sensors.

## I. INTRODUCTION

Agriculture is the strength of the Indian Economy. However, water usage for agriculture exceeds annual rainfall. Improving farm yield is essential to meet the rapidly growing demand for food for population growth across the world. By considering and predicting environmental circumstances, farm yield can be increased. Crop quality is based on data collected from fields such as soil moisture, ambient temperature, humidity etc. Farm output can be increased by using advanced equipment and technology [9].

Agriculture is an important sector of the Indian economy as it contributes about 17% to the total GDP and supplies employment to over 60% of the population. The last few decades have seen an impressive development in Indian agriculture. Since independence, the production of food grains has grown, from 51 million tonnes (MT) in 1950–1951 to 250 MT in 2011–2012. During the same time span, the production of oilseeds (the nine major oilseeds) also increased from 5 MT to 28 MT. Agriculture in India has made a mark on the world stage thanks to the development. When it comes to the output of different agrarian products like paddy, wheat, pulses, groundnuts, rapeseeds, fruits, vegetables, sugarcane, tea, jute, cotton, tobacco leaves, etc., India is among the top three countries (GOI, 2008-09). However, on the marketing front, Indian agriculture is still struggling with issues like a lack of market connectivity and integration, as well as producers' lack of access to timely, accurate information about a variety of issues in agriculture [10].

There are many ways that crops may be impacted by climate change. Warming tends to decrease yields above a certain temperature range because crops grow more quickly and produce less grain. Additionally, greater temperatures hinder plants' ability to absorb and use moisture. When temperatures climb, plants increase transpiration, or the loss of more moisture from their leaves, which speeds up soil evaporation. The overall result is referred to as "evapotranspiration." The overall effect of higher temperatures on water availability is a race between higher evapotranspiration and higher precipitation because global warming is likely to increase rainfall. Higher evapotranspiration typically wins that



competition. Developing IoT (Internet of Things) technologies can help to collect copious amounts of environmental and crop recital data. Climate change is a major factor in unpredictable weather and rainfall patterns. As many of the farmers depend on the monsoons which occur for about four months of the year, changes due to this unpredictable nature of weather harm the crop yield, and tend to incur losses. To meet rising demand and reduce output losses, Internet of Things applications in agriculture focus on conventional farming operations. Robots, drones, remote sensors, computer imaging, along with constantly improving machine learning and analytical tools, are used in agriculture by IoT to watch crops, survey, and map fields, and provide data to farmers for logical farm management plans that will save them time and money [11].

Smart agriculture is a solution to many global agricultural issues, like increasing team productivity, checking results, communicating with other teams and sub-units, as well as controlling market tendencies. Farms all over the globe are quickly considering integrating IoT solutions into their operational processes. By 2023, the global IoT agriculture market is predicted to reach \$30 billion (about \$92 per person in the US).

Our goal in this project is to help the farmers with their crop yields by using efficient methods for helping them during the drought season due to deficient rainfall, updating the status of soil parameters and finally helping the farmers figure out which crop is best suited for a particular season.

IoT-based smart agriculture applications could be new levers to support other emerging or common trends in agriculture, such as organic farming, family farming (complex or small spaces, specific cattle and/or cultures, preservation of particular or high-quality varieties, etc.), and enhance highly transparent farming, in addition to conventional, large farming operations [4].

Together, the internet of things and cloud computing have created a promising chance to address the problems brought on by this rising demand on a global scale. The effectiveness and quality of agricultural production, storage, and transportation can be greatly enhanced by utilizing IoT and cloud services and precision farming techniques. In this paper, we outline the design of an IoT-enabled multilayered platform for the agriculture industry. By suggesting a workable human-centric IoT strategy for agriculture with a focus on developing countries, this research supplies significant contributions [5].

To increase energy efficiency and productivity, environmental elements in agricultural projects must be monitored and controlled. Real-time monitoring enables the early identification and remediation of difficult situations. This device is developed to watch environmental conditions such as temperature, soil moisture content, and the humidity of the air and water level of agricultural land for controlling irrigation. The real-time conditions sensed data is sent to the cloud server for storing and decision-making and controlling actions for the future also [6].

The main work falls under the following:

#### *A. Sensor-based Smart Irrigation System*

The system typically consists of sensors that measure soil moisture levels, temperature, humidity, sunlight, and other factors that affect plant growth and water requirements. The data collected by these sensors is sent to a controller, which then uses algorithms to decide the amount of water needed and the best timing for irrigation. The controller can also adjust the flow rate and duration of watering based on the data collected by the sensors. Sensor-based smart irrigation systems can help to conserve water by only watering when needed, which can be particularly important in areas where water resources are scarce or where water restrictions are in place. They can also improve plant health by supplying water when and where it is needed, reducing the risk of overwatering, or underwatering. Additionally, these systems can be remotely watched and controlled, allowing for easy adjustments and maintenance.

#### *B. Internet of Things*

The Internet of Things (IoT) plays a crucial role in the development of smart irrigation systems. IoT-based smart irrigation systems use sensors, connectivity and cloud computing to collect and analyse data, allowing for efficient and precise irrigation. In IoT-based smart irrigation systems, sensors are used to measure various environmental factors such as soil moisture, temperature, humidity, and rainfall. These sensors are connected to a central control unit that uses wireless or cellular networks to send data to the cloud. In the cloud, data is analysed and processed to decide the best irrigation schedule and water amount required by plants. The control unit then sends the irrigation instructions to the irrigation system, which applies water to the plants through drip irrigation, sprinklers, or other irrigation methods.

## **II. RELATED WORK**

Smart agro systems, also known as precision agriculture, are gaining popularity in the agriculture industry due to their ability to improve crop yields, perfect resource usage, and reduce environmental impact. In this literature survey, we will review several published papers that discuss the concept and implementation of smart agro systems.

Smart Irrigation System using Machine Learning and IoT Bharath D.A. 1, S. Amith Nadig<sup>2</sup>, Manjunath G.S.<sup>3</sup> - This research recommends an automated irrigation system that makes use of ensemble learning and the internet of things. By fusing recent sensor data with weather projections, the proposed method forecasts rainfall. The system uses soil moisture sensors and weather forecast data to perfect irrigation schedules and minimizes water usage. The authors prove the feasibility of their system through experimental results and discuss the potential benefits of using Machine learning-based smart irrigation systems in agriculture [1].

A research paper on smart agriculture using IoT - Ritika Srivastava, Vandana Sharma, Vishal Jaiswal, Sumit Raj- In this paper, the authors propose an IoT-based smart agrosystem. This paper offers ideas for building a structure that will make it simple and reliable for farmers to work in the fields. Agriculture is one of the key industries where IOT-based research is taking place and new products are being introduced daily to make operations smarter and more efficient towards better output. IOT-based smart farming applications will make it possible for the agricultural sector to increase output while reducing waste [2].

A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming- Muhammad Shoaib Farooq; Shamyla Riaz; Adnan Abid; Kamran Abid; Muhammad Azhar Naeem - This paper discusses the concept of smart farming and its security, for a better understanding of IoT smart farming security, this study takes into account a variety of IoT agricultural challenges and security requirements. In addition, numerous crucial aspects of IoT-based agriculture, such as technologies, industry trends, and national policies, have also been given to assist various stakeholder groups [3].

IoT Applications in Agriculture - The demand for the growing population can be successfully met with IoT - Savaram Ravindra This article states that a Smart farming system which is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and an automated irrigation system can help farmers to monitor or keep a track of the field conditions from anywhere. IoT-based smart farming system is highly efficient when compared with the conventional approach [4].

Abdullah Na, William Isaac -Developing a human-centric agricultural model in the IoT environment- The Internet of Things is a recent development in the telecom and IT industries. Massive automation of the real world is being accomplished through IoT. Each item has embedded sensing, computing, and networking powers in the ideal Internet of Things. All these connected objects, whether they are lighting fixtures, thermostats, household appliances, or wearable accessories, have one thing in common: they all gather data that is generated by or about people in order to provide value-added services [5].

Agricultural environment monitoring system using wireless sensor networks and IoT, June 2018 - Goncalo Marquesa, Rui Pitarmab This article shows a sensor network-related IoT application for agriculture that has been put into practice and tested in a practical setting. The paper describes the experimental setup and early findings of two tests conducted to enhance the iTreeM monitoring system [6].

Smart Farming: The Future of Agriculture - Based on a more precise and resource-efficient strategy, smart farming can produce a more productive and sustainable form of agricultural production. The eternal dream of mankind will eventually come true thanks to new farms. It will provide food for our populace, which could reach 9.8 billion by 2050 [7].

Mr. Nikhil N. Salvithal, SMART IRRIGATION SYSTEM USING IOT, Journal of Engineering, Computing and Architecture - ISSN NO: 1934-7197, Volume: 10 Issue: 4, 2020 - The Indian economy's strongest sector is agriculture. However, water usage for agriculture exceeds annual precipitation. To satisfy the rapidly rising global demand for food due to population growth, farm yield must be improved [9].

Monica M, IoT based control and automation of smart irrigation system: An automated irrigation system using sensors, GSM, Bluetooth and cloud technology, 2017 International Conference on Recent Innovations in Signal

Processing and Embedded Systems (RISE) - ISBN:978-1- 5090-4761-1, October 2017 - An essential part of our economy, the agricultural sector, is responsible for a sizable portion of both our exports and GDP. With technological development, we can set up an irrigation system that is automated, allowing for efficient water use and a reduction in the farmers' workload [10].

S Nalini Durga, SMART IRRIGATION SYSTEM BASED ON SOIL MOISTURE USING IOT, International Research Journal of Engineering and Technology (IRJET) - ISSN: 2395-0056, Volume: 05 Issue: 06, June 2018- Based on information gathered from the environment, such as soilmoisture, ambient temperature, and humidity, crops are evaluated for quality. Farm output can be increased by using cutting-edge equipment and technology. Large amounts of environmental and agricultural data can be gathered with the aid of developing IoT technologies [11].

In conclusion, the papers discussed in this literature survey prove the potential benefits of using smart agro systems in agriculture, including increased crop yields, reduced resource usage, and more sustainable farming practices. These studies prove the feasibility of implementing smart agro systems using IoT and cloud computing technologies and supply insights into the design and implementation of such systems.

### III. METHODOLOGY

In this system, the moisture sensor (Potentiometer in the prototype) senses the moisture level of the soil and the Photodiode senses the intensity of the incident light. The moisture sensor senses the amount of water content in the soil and gives the values in form of resistance values. The pump is turned ON when the moisture level falls below a given threshold and the plants will be supplied with water. This threshold can be changed and customized according to the type of plant used and how much water that plant needs. The system has been divided mainly into two subproblems, one being when there is an ample amount of sunlight available to let the water evaporate and one being when there isn't an ample amount of sunlight, probably nighttime. When the Photodiode senses that there isn't enough sunlight then it does not power on the motor /pump even when there isn't an ample amount of moisture in the soil whereas when there is an ample amount of sunlight available the soil moisture sensor(Potentiometer here) senses the current level of moisture content in the soil and when the moisture content of the soil reaches below a custom threshold then it automatically switches on the pump with the help of ESP32 and irrigates the plant until the desired moisture level isn't reached. The overall activity is reported to the user by mobile app.

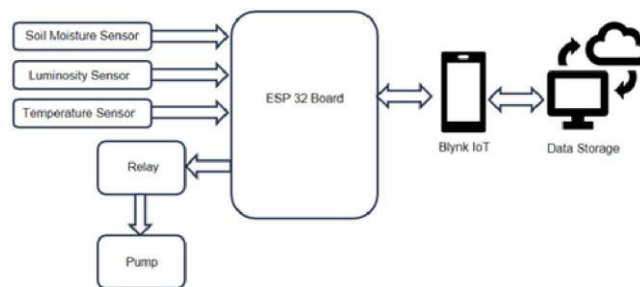


Fig 1. Block Diagram

Once the motor pump is running, the automated condition below will operate.

- 1) User can switch OFF the motor if he desires by a click on the web page- The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level goes below the desired and limited level, the moisture sensor sends the signal to the ESP32 which triggers the Water Pump to turn ON and supply the water to respective plant.
- 2) Once the soil moisture sensor reaches the necessary threshold value, the motor pump will immediately be turned OFF.
- 3) If the weather condition is such that it started raining, then the ESP32 will shut down the motor pump till it rains, and after that it checks whether the soil moisture sensor has reached the threshold value or not. The motor pump will stay off if it crosses the threshold value; otherwise, it will restart automatically. This serves to conserve electricity and water resources.



4) The automation is achieved by turning the motor on and off using the threshold values embedded in the code. The status for the same is alerted to the users through messages using ESP32.

$$\text{Soil Moisture} = \frac{\text{Water fraction}}{\text{Volume}}$$

$$y = \frac{m}{x} + c$$

Where,

y = soil moisture level

x = rise in temperature

c = constant

m = slope

$$y = \frac{85}{x} + c$$

5) Additionally, if the power is interrupted, and the engine is turned off. The user won't need to worry about manually restarting the motor pump because it will restart itself when a power source is available.

#### IV. EXPERIMENTAL RESULTS

```

Temperature: 22.70 *C
Humidity: 51.60 %
Soil Moisture: 3301
Relay is ON
0.00
Temperature: 22.70 *C
Humidity: 51.60 %
Soil Moisture: 3289
Relay is ON
0.00
Temperature: 22.70 *C
Humidity: 51.60 %
Soil Moisture: 3310
Relay is ON
0.00
Temperature: 22.70 *C
Humidity: 51.80 %
Soil Moisture: 3308
Relay is ON
0.00
Temperature: 22.70 *C
Humidity: 51.80 %
Soil Moisture: 3312
Relay is ON
0.00
Temperature: 22.70 *C
Humidity: 51.80 %
Soil Moisture: 3312
Relay is ON
0.00
Temperature: 22.70 *C

```

(a)



(b)

Fig 2. Outputs (a); (b)

## V. CONCLUSION

With less time, less work, and greater profitability, this Internet of Things-based smart irrigation monitoring and controlling system makes it quite simple to boost crop productivity during any season. The main aim of this system is to make it more innovative, convenient and efficient

Integration with Artificial Intelligence (AI) and Machine Learning (ML): Smart irrigation systems can be compared to other existing systems. This system can be deployed in places with scarcity of water. In this project a prototype includes sensing element node and data storage. The sensing element node is deployed on the field for sensing the soil parameters such as temperature, moisture, luminosity and humidity. Thus the “Smart Irrigation system based on soil moisture using ESP32” has been designed and tested successfully. It has been developed by integrated features of all the hardware components used. The system has been tested to function automatically. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully.

## REFERENCES

- [1] Smart Irrigation System using Machine Learning and IoT Bharath D.A. 1, S. Amith Nadig<sup>2</sup>, Manjunath G.S.<sup>3</sup> <https://www.irjet.net/archives/V9/i6/IRJET-V9I6376>.
- [2] A research paper on smart agriculture using iot - Ritika Srivastava, Vandana Sharma, Vishal Jaiswal, Sumit Raj <https://www.irjet.net/archives/V7/i7/IRJET-V7I7479>.
- [3] A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming- Muhammad Shoaib Farooq; Shamyla Riaz; Adnan Abid; Kamran Abid; Muhammad Azhar Naeem <https://ieeexplore.ieee.org/abstract/document/8883163>.
- [4] An article - IoT Applications in Agriculture, January 2018, [online] Available: <https://www.iotforall.com/iot-applications-in-agriculture/>.
- [5] Abdullah Na, William Isaac -Developing a human-centric agricultural model in the IoT environment <https://ieeexplore.ieee.org/document/7562740>.
- [6] Agricultural environment monitoring system using wireless sensor networks and IoT, June 2018 - Goncalo Marquesa, Rui



Pitarmab [https://www.researchgate.net/publication/326047883\\_Agricultural\\_environment\\_monitoring\\_system\\_using\\_wireless\\_sensor\\_networks\\_and\\_IoT](https://www.researchgate.net/publication/326047883_Agricultural_environment_monitoring_system_using_wireless_sensor_networks_and_IoT).

[7] An article Smart Farming: The Future of Agriculture - <https://www.iotforall.com/smart-farming-future-of-agriculture>.

[8] Quy, V.K.; Hau, N.V.; Anh, D.V.; Quy, N.M.; Ban, N.T.; Lanza, S.; Randazzo, G.; Muzirafuti, A. IoT-Enabled Smart Agriculture: Architecture, Applications, and Challenges. Appl. Sci. 2022, 12, 3396 <https://doi.org/10.3390/app12073396>.

[9] Mr. Nikhil N. Salvithal, SMART IRRIGATION SYSTEM USING IOT, Journal of Engineering, Computing and Architecture - ISSN NO: 1934-7197, Volume: 10 Issue: 4, 2020.

[10] Monica M, IoT based control and automation of smart irrigation system: An automated irrigation system using sensors, GSM, Bluetooth and cloud technology, 2017 International Conference on Recent Innovations in Signal processing and Embedded Systems (RISE) - ISBN:978-1-5090-4761-1, October 2017.

[11] S Nalini Durga, SMART IRRIGATION SYSTEM BASED ON SOIL MOISTURE USING IOT, International Research Journal of Engineering and Technology (IRJET) - ISSN: 2395-0056, Volume: 05 Issue: 06, June 2018.





**INNO SPACE**  
SJIF Scientific Journal Impact Factor  
**Impact Factor: 8.423**



**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

9940 572 462 6381 907 438 [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details